

CLAIMS

1 [Claim 1]

2 A composition for a charge-transport film,

3 comprising at least:

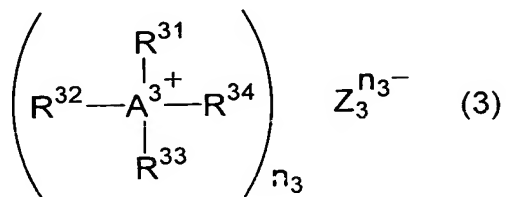
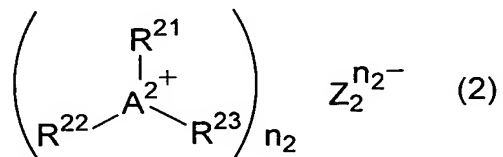
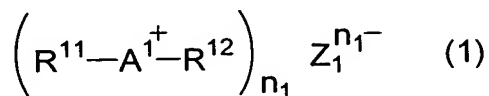
4 a charge-transporting compound; and

5 an ionic compound selected from the group

6 consisting of the compounds expressed by the

7 following general formulae (1)-(3),

8 [Chemical Formula 1]



9

10 wherein in general formulae (1)-(3):

11 R^{11} , R^{21} and R^{31} represent, independently of each

12 other, an organic group bound to A^1-A^3 ,

13 respectively, via a carbon atom;

14 R^{12} , R^{22} , R^{23} and $R^{32}-R^{34}$ represent, independently of

15 each other, an arbitrary group; two or more

16 neighboring groups of R^{11} - R^{34} may combine together
17 to form a ring;
18 A^1 - A^3 each represent an element belonging to the
19 third and subsequent periods in the periodic
20 table;
21 A^1 represents an element belonging to group 17 of
22 the long form periodic table;
23 A^2 represents an element belonging to group 16 of
24 the long form periodic table;
25 A^3 represents an element belonging to group 15 of
26 the long form periodic table;
27 Z_1^{n1-} - Z_3^{n3-} represent, independently of each other,
28 a counter anion; and
29 $n1$ - $n3$ represent, independently of each other, an
30 ionic valency of the counter anion.

1 [Claim 2]

2 A composition for a charge-transport film as
3 defined in claim 1, wherein in the general
4 formulae (1)-(3), R^{11} , R^{21} , R^{31} represent,
5 independently of each other, an alkyl group, an
6 alkenyl group, an alkynyl group, an aromatic
7 hydrocarbon group or an aromatic heterocyclic
8 group, which may be substituted.

1 [Claim 3]

2 A composition for a charge-transport film as
3 defined in claim 1 or claim 2, wherein in the
4 general formulae (1)-(3), R^{12} , R^{22} , R^{23} and R^{32} - R^{34}
5 represent, independently of each other, an alkyl
6 group, an alkenyl group, an alkynyl group, an
7 aromatic hydrocarbon group or an aromatic
8 heterocyclic group, which may be substituted.

1 [Claim 4]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-3, wherein in the
4 general formulae (1)-(3), R^{11} - R^{34} represent,
5 independently of each other, an aromatic
6 hydrocarbon group or an aromatic heterocyclic
7 group, which may be substituted.

1 [Claim 5]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-4, wherein in the
4 general formula (1), A^1 is a bromine atom or an
5 iodine atom, and in the general formula (2), A^2 is
6 a selenium atom or a sulfur atom.

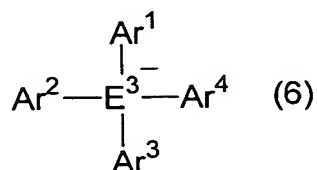
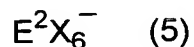
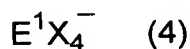
1 [Claim 6]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-5, wherein in the
4 general formula (1), A^1 is an iodine atom.

1 [Claim 7]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-6, wherein in the
4 general formulae (1)-(3), Z_1^{n1-} - Z_3^{n3-} are expressed,
5 independently of each other, by any one of the
6 general formulae (4)-(6),

7 [Chemical Formula 2]



8

9 wherein in the general formulae (1)-(3):

10 E^1 and E^3 represent, independently of each other,
11 an element belonging to group 13 of the long form
12 periodic table;

13 E^2 represents an element belonging to group 15 of
14 the long form periodic table;

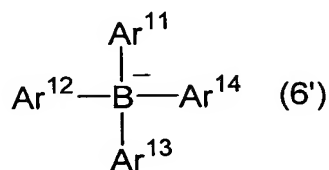
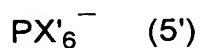
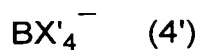
15 X represents a halogen atom; and

16 Ar^1 - Ar^4 represent, independently of each other, an
17 aromatic hydrocarbon group or an aromatic
18 heterocyclic group, which may be substituted.

1 [Claim 8]

2 A composition for a charge-transport film as
 3 defined in claim 7, wherein in the general
 4 formulae (4)-(6), Z_1^{n1-} - Z_3^{n3-} are expressed,
 5 independently of each other, by the following
 6 general formulae (4')-(6'),

7 [Chemical Formula 3]



8
 9 wherein in the general formulae (4')-(6'):
 10 X' represents a fluorine atom or a chlorine atom;
 11 Ar^{11} - Ar^{14} represent, independently of each other,
 12 an aromatic hydrocarbon group which may be
 13 substituted or an aromatic heterocyclic group
 14 which may be substituted; and
 15 at least one group of Ar^{11} - Ar^{14} has one or plural
 16 fluorine atoms or chlorine atoms as substituents.

1 [Claim 9]

2 A composition for a charge-transport film as
 3 defined in any one of claims 1-8, wherein said
 4 charge-transporting compound is an aromatic
 5 tertiary amine compound.

1 [Claim 10]

2 A composition for a charge-transport film as
3 defined in claim 9, wherein said aromatic tertiary
4 amine compound is a macromolecule compound whose
5 weight-average molecular weight is 1000 or larger
6 and 1000000 or smaller.

1 [Claim 11]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-10, further
4 comprising an ether solvent and/or an ester
5 solvent that dissolves said charge-transporting
6 compound and said ionic compound.

1 [Claim 12]

2 A composition for a charge-transport film as
3 defined in any one of claims 1-11, wherein said
4 composition is used as a material for a charge-
5 transport layer of an organic electroluminescence
6 device.

1 [Claim 13]

2 An organic electroluminescence device,
3 comprising:
4 a substrate;
5 an anode and cathode formed on said
6 substrate;

7 an emitting layer disposed between said
8 anode and said cathode; and
9 a layer formed between said anode and said
10 emitting layer using a composition for a charge-
11 transport film as defined in any one of claims 1-
12 12.

1 [Claim 14]

2 An organic electroluminescence device as
3 defined in claim 13, wherein in said layer formed
4 using said composition for a charge-transport film,
5 the content of said ionic compound is 0.1 weight %
6 or higher and 50 weight % or lower.

1 [Claim 15]

2 An organic electroluminescence device as
3 defined in claim 13 or claim 14, further
4 comprising a hole-injection layer and/or a hole-
5 transport layer between said anode and said
6 emitting layer, wherein said hole-injection layer
7 and/or said hole-transport layer is formed using a
8 composition for a charge-transport film as defined
9 in any one of claims 1-12.

1 [Claim 16]

2 An organic electroluminescence device as
3 defined in any one of claims 13-15, wherein said

4 layer using said composition for a charge-
 5 transport film is formed by wet coating method.

1 [Claim 17]

2 An organic electroluminescence device,
 3 comprising:

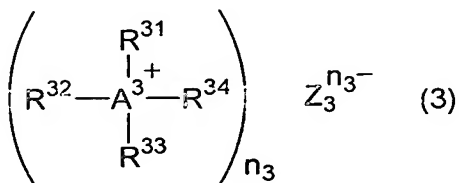
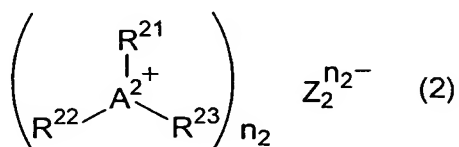
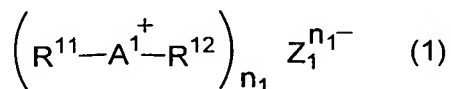
4 a substrate;

5 an anode and a cathode formed on said
 6 substrate;

7 an emitting layer disposed between said
 8 anode and said cathode;

9 a layer, disposed between said anode and
 10 said cathode, that contains an ionic compound
 11 selected from the group consisting of the
 12 compounds expressed by the following general
 13 formulae (1)-(3),

14 [Chemical Formula 4]



15

16 wherein in general formulae (1)-(3):
17 R^{11} , R^{21} and R^{31} represent, independently of each
18 other, an organic group bound to A^1 - A^3 ,
19 respectively, via a carbon atom;
20 R^{12} , R^{22} , R^{23} and R^{32} - R^{34} represent, independently of
21 each other, an arbitrary group; two or more
22 neighboring groups of R^{11} - R^{34} may combine together
23 to form a ring;
24 A^1 - A^3 each represent an element belonging to the
25 third and subsequent periods in the periodic
26 table;
27 A^1 represents an element belonging to group 17 of
28 the long form periodic table;
29 A^2 represents an element belonging to group 16 of
30 the long form periodic table;
31 A^3 represents an element belonging to group 15 of
32 the long form periodic table;
33 Z_1^{n1} - Z_3^{n3} represent, independently of each other,
34 a counter anion; and
35 $n1$ - $n3$ represent, independently of each other, an
36 ionic valency of the counter anion.

1 [Claim 18]

2 A method of producing an organic
3 electroluminescence device as defined in any one
4 of claims 13-16, comprising the step of drying
5 said composition for a charge-transport film by

6 heating at a higher temperature than the glass
7 transition temperature of said charge-transporting
8 compound.

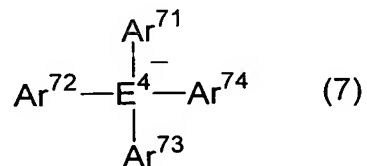
1 [Claim 19]

2 A method of producing a charge-transport
3 film by wet coating method using a composition for
4 a charge-transport film as defined in any one of
5 claims 1-12, comprising the step of drying said
6 composition for a charge-transport film by heating
7 at a higher temperature than the glass transition
8 temperature of said charge-transporting compound.

1 [Claim 20]

2 An ionic compound composed of a cation
3 radical of a charge-transporting compound and a
4 counter anion, wherein said counter anion is
5 expressed by the following general formula (7)

6 [Chemical Formula 5]



7
8 wherein in the general formula (7):

9 E⁴ represents an element belonging to group 13 of
10 the long form periodic table; and

11 Ar⁷¹-Ar⁷⁴ represent, independently of each other,
12 an aromatic hydrocarbon group that may have

13 substituents or an aromatic heterocyclic group
14 that may have substituents.

1 [Claim 21]

2 An ionic compound as defined in claim 20,
3 wherein said cation radical of a charge-
4 transporting compound is an aminium cation radical.

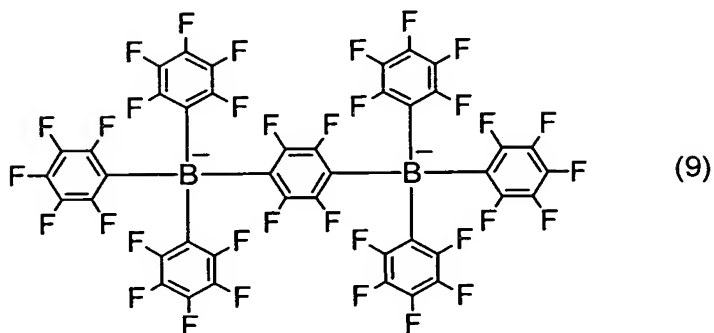
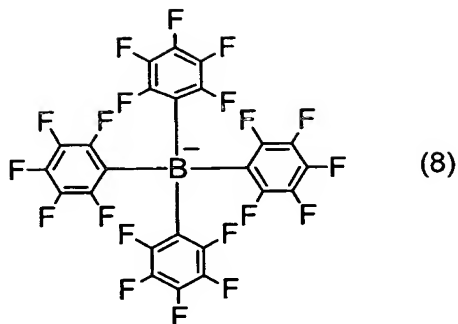
1 [Claim 22]

2 An ionic compound as defined in claim 20 or
3 claim 21, wherein in the general formula (7), E⁴
4 is a boron atom or a gallium atom, and at least
5 one of Ar⁷¹-Ar⁷⁴ is a group that has one or plural
6 electron-accepting substituents or nitrogen-
7 containing aromatic heterocyclic groups.

1 [Claim 23]

2 An ionic compound as defined in any one of
3 claims 20-22, wherein said counter anion is
4 expressed by the following formula (8) or formula
5 (9)

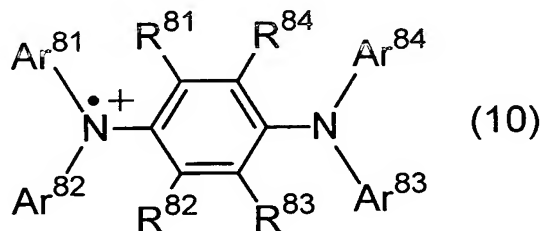
6 [Chemical Formula 6]



[Claim 24]

An ionic compound as defined in any one of claims 20-23, wherein said cation radical of the charge-transporting compound is expressed by the following general formula (10),

[Chemical Formula 7]



wherein in the general formula (10):

Ar⁸¹-Ar⁸⁴ represent, independently of each other, an aromatic hydrocarbon group that may have

11 substituents or an aromatic heterocyclic group
12 that may have substituents; and
13 R^{81} - R^{84} represent, independently of each other, an
14 arbitrary group.

1 [Claim 25]

2 An ionic compound as defined in any one of
3 claims 20-24, wherein said cation radical of the
4 charge-transporting compound has a structure
5 obtained by removing an electron from a repetitive
6 unit of an aromatic tertiary amine macromolecule
7 compound whose weight-average molecular weight is
8 1000 or larger and 1000000 or smaller.

1 [Claim 26]

2 An ionic compound as defined in any one of
3 claims 20-24, wherein said compound is used as an
4 ingredient of a charge-transport film.

1 [Claim 27]

2 A composition for a charge-transport film,
3 comprising an ionic compound as defined in any one
4 of claims 20-26.

1 [Claim 28]

2 A composition for a charge-transport film as
3 defined in claim 27, wherein said composition is

4 used as a material for a charge-transport layer of
5 an organic electroluminescence device.

1 [Claim 29]

2 A charge transport film, comprising an ionic
3 compound as defined in any one of claims 20-26.

1 [Claim 30]

2 An organic electroluminescence device,
3 comprising:
4 a substrate;
5 an anode and a cathode formed on said
6 substrate;
7 an emitting layer disposed between said
8 anode and said cathode; and
9 a layer disposed between said anode and said
10 cathode, said layer containing an ionic compound
11 as defined in any one of claims 20-26.

1 [Claim 31]

2 An organic electroluminescence device,
3 comprising:
4 a substrate;
5 an anode and a cathode formed on said
6 substrate;
7 an emitting layer disposed between said
8 anode and said cathode; and

9 a layer disposed between said anode and said
10 cathode, said layer being formed by wet
11 application method using a composition for a
12 charge-transport film as defined in claim 27 or
13 claim 28.

1 [Claim 32]

2 An electron-accepting compound to be
3 contained in a charge-transport film together with
4 a charge-transporting compound, wherein a
5 resistivity RR_1 [Ωcm] of a charge-transport film 1,
6 which is composed of said electron-accepting
7 compound and a charge-transporting compound, and
8 resistivity RR_0 [Ωcm] of a charge-transport film 2,
9 which is composed of a charge-transporting
10 compound, meet the following relation

11
$$RR_1/RR_0 < 8 \times 10^{-2}$$

12 on the conditions:

13 that a same compound is used as the charge-
14 transporting compounds contained in the charge-
15 transport film 1 and the charge-transport film 2;
16 and

17 that the resistivity is the value of {field
18 intensity [V/cm]/current density [A/cm^2] } where
19 the {field intensity [V/cm]/current density
20 [A/cm^2] } is obtained from a field intensity to be
21 applied when a charge-transport film having a film

22 thickness of between 100-200 nm and a current-
23 carrying area of 0.04 cm² carries an electric
24 current corresponding to a current density of
25 between 4-6 mA/cm² while being sandwiched between
26 an anode and a cathode.

1 [Claim 33]

2 A composition for a charge-transport film,
3 comprising:
4 a charge-transporting compound; and
5 an electron-accepting compound as defined in
6 claim 32.

1 [Claim 34]

2 A charge transport film, comprising:
3 a charge-transporting compound; and
4 an electron-accepting compound as defined in
5 claim 32.

1 [Claim 35]

2 An organic electroluminescence device,
3 comprising a charge-transport film as defined in
4 claim 34.